Designing technologies

for the communities with CHILDREN

A toolkit to conduct co-design activities with children to create sustainable livelihood options for the community

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This toolkit was developed as a part of the SBI Youth for India Fellowship by Krishna Thiruvengadam and Shreyas Prakash:

Designing Technologies for the community with children: Theoretical reflections and practical inquiry towards a co-design toolkit.

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Designing technologies

for the communities with CHILDREN

A toolkit to help children and youngsters to develop solutions for local problems locally

KRISHNA RAJAGOPAL
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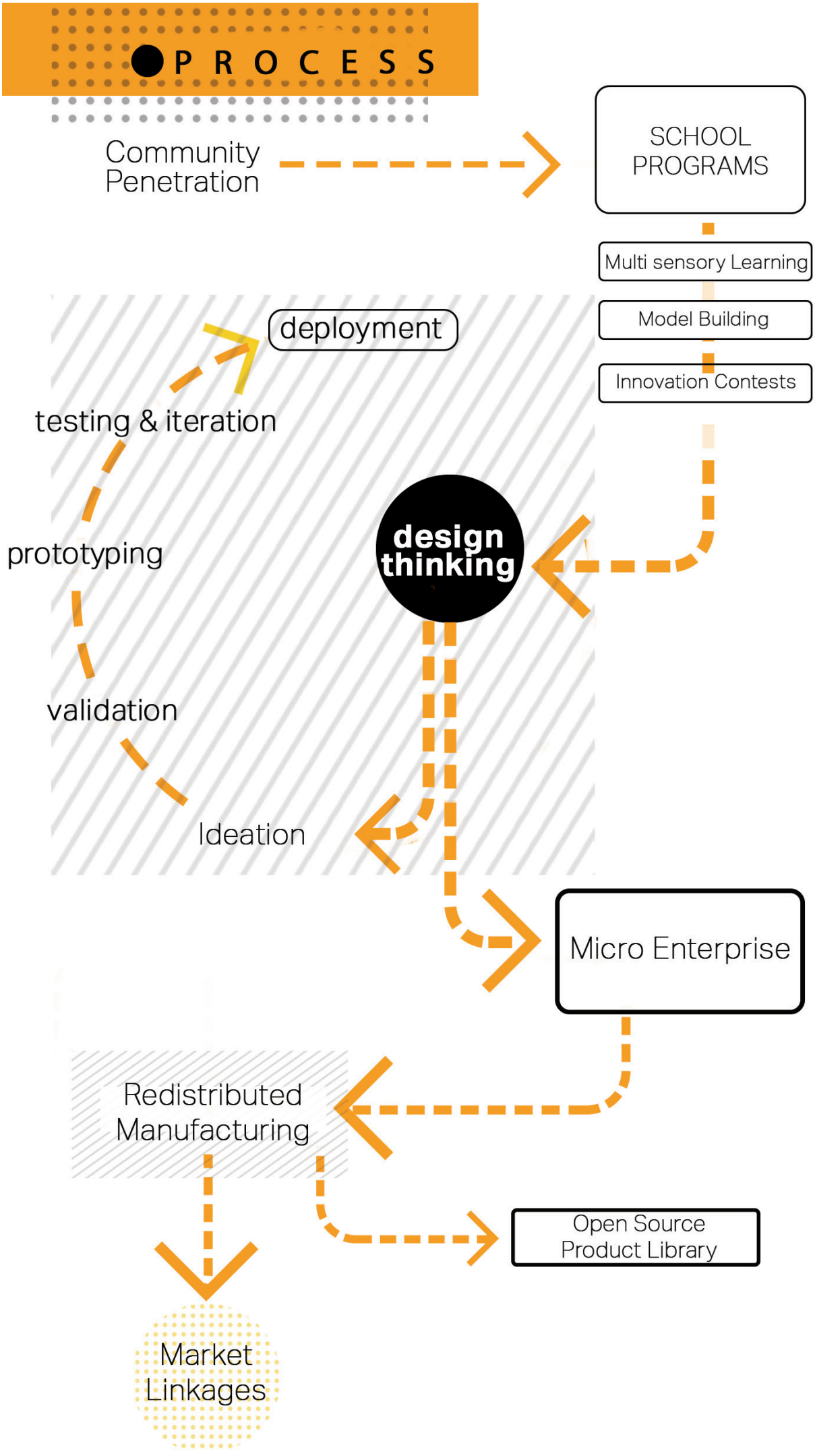
Introduction to the Toolkit

The toolkit was designed with an intention of enabling the local community to solve their own problems using solutions available in their midst. As it has been observed that children empathize with their families and people in their community, the design thinking toolkit has been developed to specially involve them in the process, thereby bridging the gap between mainstream education and practical application of knowledge. By encouraging indigenous practices and by bridging their gap with modern techniques, the toolkit focusses on co-creation techniques which could lead to sustainable livelihood options.


PROCESS
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Unconditioning the mind

BREAKING THE ICE

5 days
(parallel)

- Students
- Facilitator

- Craft materials
- Projector

Teachers and school management are introduced to the various aspects of the project, modules and the intended outcomes.

Several ice-breaking sessions are organised which include playing games, arts and crafts, watching educational movies and so on.

CREATIVE THINKING

Students are given a theme and encouraged to speak/ write/ draw their thoughts about it. For example, if one has no hair on their head, what would they like to have? The emphasis is on creative storytelling and thinking out of the box.

Certain puzzles are also given to the children which act as intuition pumps.

5 days
(parallel)

- Students
- Facilitator

- Drawing paper
- Pencils

NATURE WALKS

Students are taken around the village where they relate what they learnt in the classroom with what they see and observe in their day to day life. Environmental context is a very important phase in their learning process and by linking the environment with what is being taught in the classroom, it nurtures their sense of awareness.

Through these walks they are also encouraged to identify key issues pertaining to their village as they might have got inured to certain issues as they might see it everyday,

(parallel)

- Students
- Facilitator

SKETCHING

Students are encouraged to pick up simple objects around them for drawing. Detailing is appreciated and a sense of perspective is taught to them to use it further for technical drawings.

They are also encouraged to create storytelling perspectives through drawing and sketching. These exercises revolve more around design, thinking and writing rather than the actual technical part of putting pen on paper.

5 days
(parallel)

- Students
- Facilitator

- Drawing paper
- Pencils

CRAFTING

Sustainable and recycling materials through crafting (like Quilling, paper weaving and crochet making)

These give an outlet for venting out their positive emotions and also aid in fine motor skills and dexterity development, thereby stimulating their neural activity.

5 days
(parallel)

- Students
- Facilitator

- Newspaper
- Quiling strips

Multi Sensory Learning

GOAL

To deliberately use sight, sound, movement and touch to help kids connect language to words.

MULTI-SENSORY LEARNING

Science and math concepts are taught using an integrated visual, auditory and kinesthetic model

The facilitator imparts activities through which students learn science, math and art as an integrated discipline. Indigenous activities are preferred to instill the same.

CURIOSITY COMES FIRST

The facilitator discusses few upcoming projects that closely adhere to the syllabus beforehand with the teachers so that they do not find it hard to participate.

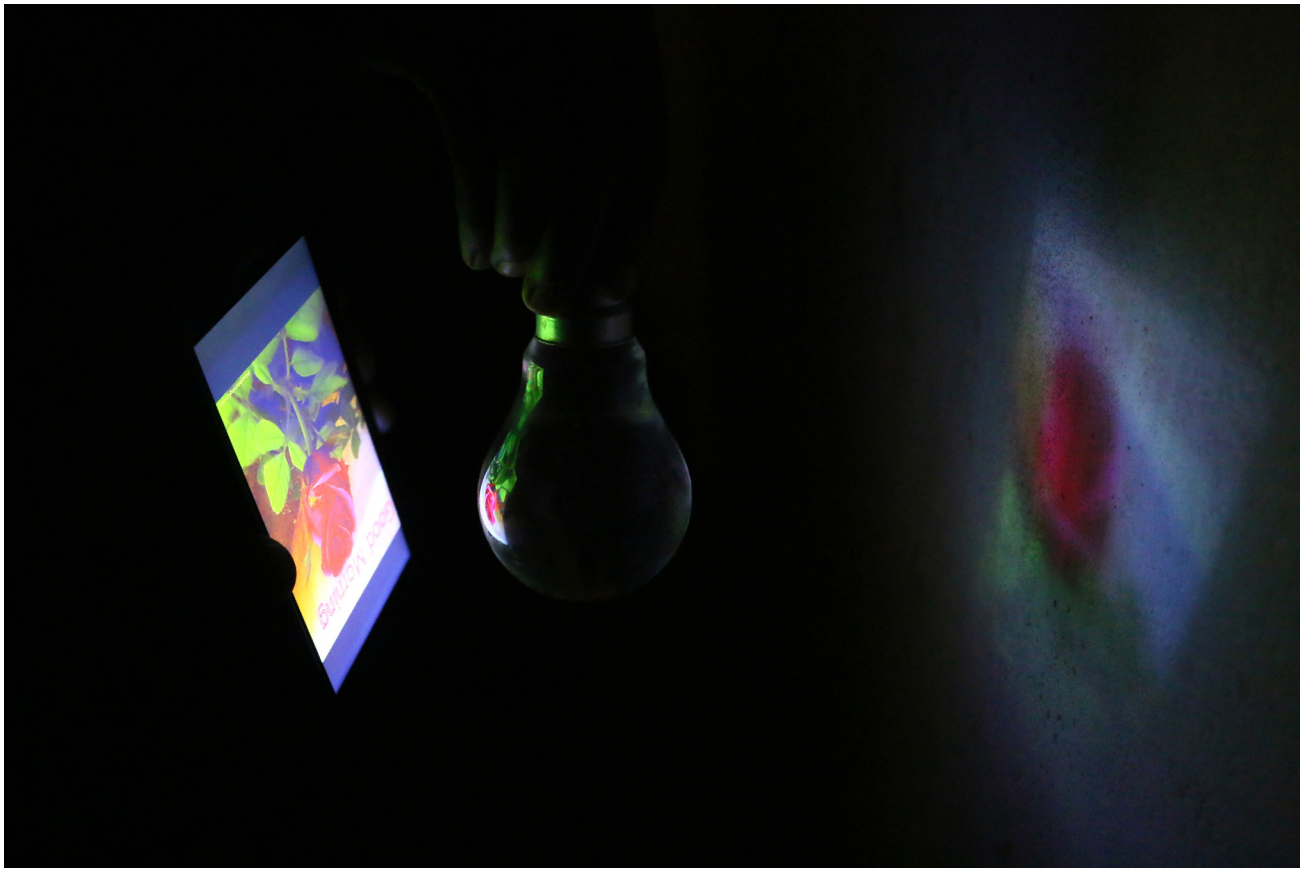
Teacher introduces the concept briefly at the start of the session of 40 minutes. Facilitator builds a functional model in front of the students during the session to spark their curiosity. He/ she then encourages students to raise inquiries about the model.

The teacher explains the theory behind the concept and encourages student reflections of what they learnt. Innovative applications are encouraged.

5 days (parallel)

- Students
- Facilitator

- Projector
- Objects of perception



BASIC MODELLING

Facilitator brings two or three functional popsicle models to the classroom and keeps the mode on a centre of the class for reference or circulates it for the students to explore visually.

The students are given defined sets of material to replicate the model presented by the facilitator

Facilitator then initiates a conversation about the model and its applications and ask the kids how they would use it in a creative way.

5 days
(parallel)

- Students
- Facilitator

- Popsicle sticks
- Glue gun

BASIC MODELLING

The classroom is divided into groups usually a mix of boy and girls and each group is asked to pick up a team name for themselves. This group could remain the same throughout all the modules and each group should be evaluated at the end of each session by the facilitator/ teacher.

The session is not intended to be competitive and should be allowed to be done in their own pace. However completion within the session timing is encouraged. For longer projects, two sessions could be utilised.

5 days
(parallel)

- Students
- Facilitator

- Clay
- Popsicle sticks
- Cycle valves

ADVANCED MODELLING

The facilitator places assorted materials box in the classroom and asks the students to build any model they would like from the manual individually.

Creative out of the box models are encouraged and appreciated. The facilitator also builds the model on his/ her own (Acts as a reference point and not the center of attention in the class)

5 days (parallel)

- Students
- Facilitator

- Waste to be upcycled
- Assorted box

THEMATIC MODELLING

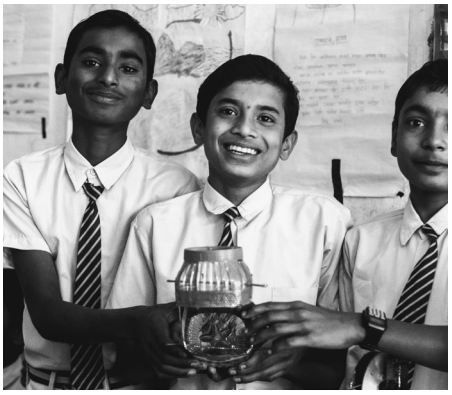
The facilitator places assorted materials box in the classroom and asks the students to build any model they would like from the manual individually

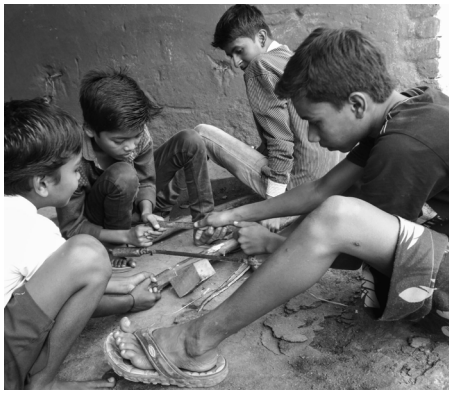
Creative out of the box models are encouraged and appreciated. The facilitator also builds the model on his/ her own (Acts as a reference point and not the center of attention in the class)

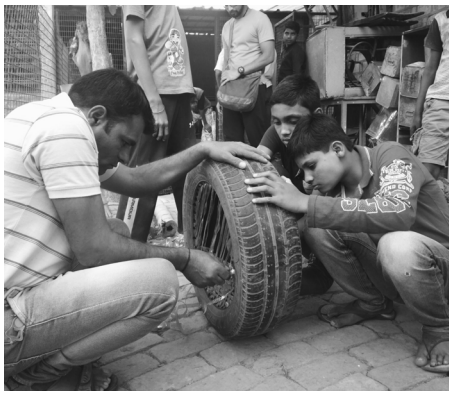
5 days
(parallel)

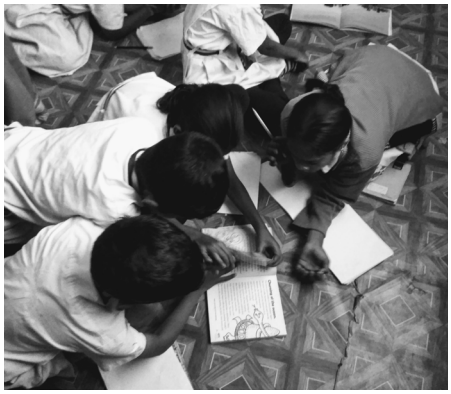
- Students
- Facilitator

- Theme based items





OVER THE HILL




PHASE IV
ASSESSMENT

GOAL

Final assessment and validation of the process till now.

The facilitator announces one big challenge to the class and asks the student groups to find a solution through modelling. The facilitator questions the students critically on a continual basis. Students are encouraged to seek ideas/help from the facilitator/ community members/ teachers.

Students are asked to report to the facilitator about their findings/ ideas every day and the facilitator questions the students so as to make them think deeper about the ideas/ solution they are developing.

The group who completes it will later answer questions related to the idea (why that particular design was made etc) asked by the facilitator and gets a point (noted on the assessment card). No time based competition is intended and students can build them in their own pace (one challenge per week) The completed projects are displayed in the school showcase (for a sense of pride and sense of achievement)

PROJECT DESIGN RUBRIC

Essential Project Design Element	Lacks Features of Effective PBL *The project has one or more of the following problems in each area:*	Needs Further Development *The project includes some features of effective PBL but has some weaknesses:*	Includes Features of Effective PBL *The project has the following strengths:*
Key Knowledge, Understanding & Success Skills	▸ Student learning goals are not clear and specific; the project is not focused on standards. ▸ The project does not explicitly target, assess, or scaffold the development of success skills.	▸ The project is focused on standards-derived knowledge and understanding, but it may target too few, too many, or less important goals. ▸ Success skills are targeted, but there may be too many to be adequately taught and assessed.	▸ The project is focused on teaching students specific and important knowledge, understanding, and skills derived from standards and central to academic subject areas. ▸ Important success skills are explicitly targeted to be taught and assessed, such as critical thinking/problem solving, collaboration, and self-management.
Challenging Problem or Question	▸ The project is not focused on a central problem or question (it may be more like a unit with several tasks); or the problem or question is too easily solved or answered to justify a project. ▸ The central problem or question is not framed by a driving question for the project, or it is seriously flawed, for example: – it has a single or simple answer. – it is not engaging to students (it sounds too complex or "academic" like it came from a textbook or appeals only to a teacher).	▸ The project is focused on a central problem or question, but the level of challenge might be inappropriate for the intended students. ▸ The driving question relates to the project but does not capture its central problem or question (it may be more like a theme). ▸ The driving question meets some of the criteria (in the Includes Features column) for an effective driving question, but lacks others.	▸ The project is focused on a central problem or question, at the appropriate level of challenge. ▸ The central problem or question is framed by a driving question for the project, which is: – open-ended; it will allow students to develop more than one reasonable answer. – understandable and inspiring to students. – aligned with learning goals; to answer it, students will need to gain the intended knowledge, understanding, and skills.
Sustained Inquiry	▸ The "project" is more like an activity or "hands-on" task, rather than an extended process of inquiry. ▸ There is no process for students to generate questions to guide inquiry.	▸ Inquiry is limited (it may be brief and only occur once or twice in the project; information-gathering is the main task; deeper questions are not asked). ▸ Students generate questions, but while some might be addressed, they are not used to guide inquiry and do not affect the path of the project.	▸ Inquiry is sustained over time and academically rigorous (students pose questions, gather & interpret data, develop and evaluate solutions or build evidence for answers, and ask further questions). ▸ Inquiry is driven by student-generated questions throughout the project.

Authenticity	▸ The project resembles traditional "schoolwork;" it lacks a real-world context, tasks and tools, does not make a real impact on the world or speak to students' personal interests.	▸ The project has some authentic features, but they may be limited or feel contrived.	▸ The project has an authentic context, involves real-world tasks, tools, and quality standards, makes a real impact on the world, and/or speaks to students' personal concerns, interests, or identities.
Student Voice & Choice	▸ Students are not given opportunities to express voice and choice affecting the content or process of the project. ▸ Students are expected to work too much on their own, without adequate guidance from the teacher and/or before they are capable.	▸ Students are given limited opportunities to express voice and choice, generally in less important matters (deciding how to divide tasks within a team or which website to use for research). ▸ Students work independently from the teacher to some extent, but they could do more on their own.	▸ Students have opportunities to express voice and choice on important matters (questions asked, texts and resources used, people to work with, products to be created, use of time, organization of tasks). ▸ Students have opportunities to take significant responsibility and work as independently from the teacher as is appropriate, with guidance.
Reflection	▸ Students and the teacher do not engage in reflection about what and how students learn or about the project's design and management.	▸ Students and teachers engage in some reflection during the project and after its culmination, but not regularly or in depth.	▸ Students and teachers engage in thoughtful, comprehensive reflection both during the project and after its culmination, about what and how students learn and the project's design and management.
Critique & Revision	▸ Students get only limited or irregular feedback about their products and work-in-progress, and only from teachers, not peers. ▸ Students do not know how or are not required to use feedback to revise and improve their work.	▸ Students are provided with opportunities to give and receive feedback about the quality of products and work-in-progress, but they may be unstructured or only occur once. ▸ Students look at or listen to feedback about the quality of their work, but do not substantially revise and improve it.	▸ Students are provided with regular, structured opportunities to give and receive feedback about the quality of their products and work-in-progress from peers, teachers, and if appropriate from others beyond the classroom. ▸ Students use feedback about their work to revise and improve it.
Public Product	▸ Students do not make their work public by presenting it to an audience or offering it to people beyond the classroom.	▸ Student work is made public only to classmates and the teacher. ▸ Students present products, but are not asked to explain how they worked and what they learned.	▸ Student work is made public by presenting or offering it to people beyond the classroom. ▸ Students are asked to publicly explain the reasoning behind choices they made, their inquiry process, how they worked, what they learned, etc.

Design Thinking

INTRO

Once the critical thinking sessions are completed and the assessment of the children's response is positive, we introduce them to the design thinking phase of our project. These sessions require certain maturity of the process, and so, the cream of the students who have shown maximum response are involved in participatory design

नल
valve
PVC

IDEATION

5 days
(parallel)

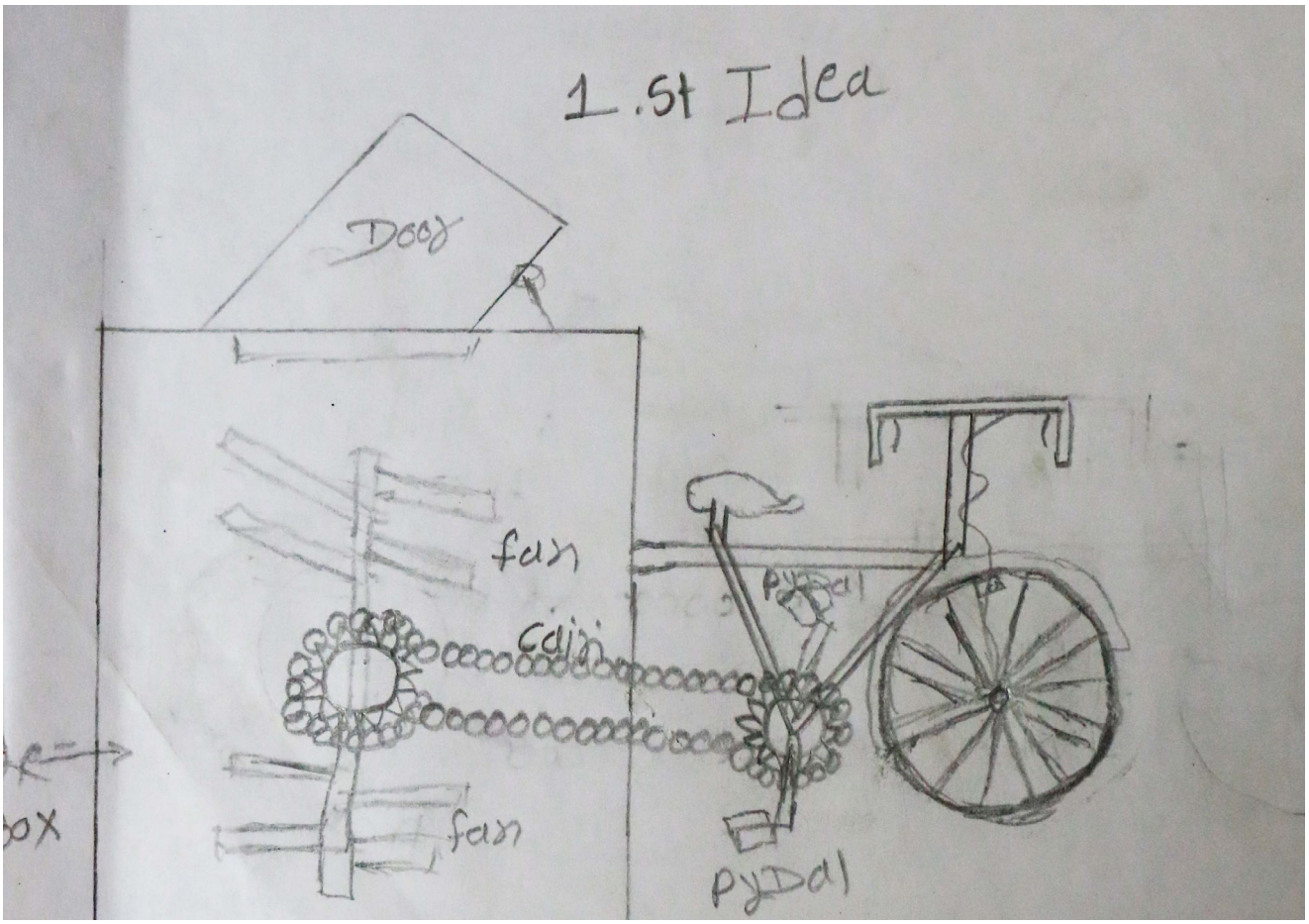
- Students
- Facilitator

- Drawing paper
- Pencils

Children are encouraged to highlight local issues and the facilitator writes the problems on the board. Encourage the children to sketch the ideas they are proposing.

Conduct field trips with the children in and around the village to observe activities and how they are done. Talk to diverse groups of locals on the process and instruments in use for their respective livelihoods.

Identify the issues on hand that will be taken up. Address them one at a time. Hold brainstorming sessions with the entire group of children present, followed by ideation to help seed ideas for the problem in question.



BOSCH
SANTRO

VALIDATION

5 days
(parallel)

- Students
- Facilitator

- Whiteboard
- Projector

Facilitator asks the right kind of questions, as a group discussion (Eg. why the problem exists, what are the cultural aspects of the situation etc) to make children reflect critically, brainstorm and refine the ideas

Discuss to see if any indigenous techniques of the community can be used towards its making; discuss with local artisans for possibilities

Carry out a what-if analysis to evaluate the commercial feasibility of the idea backed by design factors mentored by the facilitator.

Design Thinking

सिगडी

RAPID PROTOTYPING

5 days
(parallel)

- Students
- Facilitator

- Upcycled waste
- Makerspace

Children explain their ideas through mock up models (functional or non-functional)

The facilitator questions the models in terms of feasibility of the ideas (materials, comparison from existing products etc). The most feasbile idea is selected for prototyping by the consensus of the group.

Happy Happy

Design Thinking

PROTOTYPING

5 days
(parallel)

- Students
- Facilitator

- Makerspace equipments

Children determine the required parts and estimate the cost of prototyping using dHive Young Makers Manual. Once the parts are determined, the prototype is designed under the supervision of the dHive makerspace facilitator.

TESTING AND ITERATION

5 days
(parallel)

- Students
- Facilitator
- Village members

The prototype could be placed at a common place of the village where students can interact with passers-by and get more insights, their likes and dislikes.

The prototype is tested in up to three households for two days, preferably with familes of the the involved students.

The students take active feedback from their family members as well and they are encouraged by the facilitator to participate in the iteration of the prototype.

No user instructions should be provided. This will help understand how a person is likely to use or misuse it, and to avoid cognitive biases

All the feedback received at this stage should be documented in the feedback form. The feedback must form the input for the iterations that follow till the prototype becomes market ready

DEMONSTRATION

7 days

- Students
- Facilitator

- Stall setup
- Poster presentation

The partner organization organizes an expo where the finished product demonstrated by the students to the sarpanch (local governing authority), community members, teachers and other governmental officers.

Students get interesting insights, media coverage and even job orders for their products from such an event.

DOCUMENTATION

3 days)

- Facilitator
- Online documentation

The facilitators document the process evolution that happens in the village which includes product innovations and its overall value addition to the community.

The documentation is made open source so that other communities with similar makerspace setups benefit from such innovations, and could possibly modify or extend the scope of the innovations.

Entrepreneurship

FORMATION

Based on the overall feedback received from various stakeholders, and based on overall consensus, a decision is taken to launch the product for the appropriate market if there is sufficient demand for the same.

The innovators mainly involved in the R&D of the product are identified. They are engaged in further discussion to know more about how they would like to take it forward.

Feedback is also received from various women self help groups based on which target SHGs are identified based on their interest to pursue this as a micro-enterprise.

The information regarding the profile of the innovator, the interested women self-help group and the detailed report of the product-market fit is distributed to the governmental and non governmental organisations.

FORMATION

From the NGO side, various project locations with similar problems are identified. The hypothesis is that if a product has been successful in a particular community, it might have a high chance of being successful in communities of similar socio-cultural and geographical context.

Further research is done on the product market fit for other project locations in trying to establish market linkages based on which the innovator group and women SHGs get into redistributed manufacturing. Meetings are conducted between the dHive innovator groups and the women SHGs on how to take the product forward.

Based on the response, the overall decision to setup a micro-enterprise model is taken forward.

SETTING UP A PILOT

In the first phase of deployment, the dHive innovator involves in training the women self help group members to make the product.

Tasks are assigned to various members in such a way that the effort and time spent in manufacturing the product is equally distributed.

The labour cost is also added to the overall cost of the product in such a way that each member of the self-help group receives the minimum wage required as per government regulations.

SETTING UP A PILOT

Based on the first phase of deployment, and the actual manhours spent in making the product, the overall manufacturing process is assessed and adjusted in such a way that the effort to price ratio is adequate.

An agreement is made between the innovator and the women self-help group in terms of the division of profits.

For the first phase of deployment, since the innovator will be involved in training as well as monitoring the efficiency of the batch, he/she will receive 25 percent of the profit margin whereas 75 percent of the profit margin will be distributed to the women self help group members on a per head basis.

DEPLOYMENT

From the second batch of production, the innovator will receive 10 percent share whereas the women SHG members will receive 90 percent profit margin. The 10 percent royalty is received by the innovator for the intellectual property and this is immaterial of whether he contributes to the manufacturing process or not. Transportation constraints are taken into account while manufacturing locally, and certain adjustments are made to the design for better transportation.

The dHive Makerspace would provide housing/electricity for manufacturing the first two orders after which they could get support from the gram sabha in getting a separate space for their micro-enterprise. Fabrication facilities for the product is also provided by the makerspace thus functioning as an innovation hub.

Entrepreneurship